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a remarkable vertebral series extending from the 5th dorsal to the end of the tail: (1) The center of motion is the sacrum, where three vertebræ are completely coalesced to the summits of the spines, besides a fourth rib-bearing sacral with a free spine. The sacro-iliac union is by means of both ribs and neuropophysial plates. The presence of such plates in all the anterior caudals, as first described by the writer, proves that the sacrum is reenforced by additions from the anterior caudals. (2) There are more than thirty caudals and three distinct types of chevron, instead of the single type to which Marsh applied the generic name *Diplodocus*. The tail was undoubtedly a powerful swimming organ and also a lever by means of which the anterior portion of the body was elevated, the acetabulum serving as a fulcrum, while the trunk was immersed in water. This power did not exist upon land as in the Iguanodontia.

*The Ossicula Auditus of the Mammalia.* J. S. KINGSLEY and W. H. RUDDICH.

STUDIES on embryo pigs and rats show that the incus is the quadrate, the malleus, the proximal end of Meckel's cartilage. These cannot be homologized with the columellar chain of Sauropsida, since they are in front of the spiracular cleft and in front of the chorda tympani, while the columella is behind the spiracle and chorda tympani. The incus (quadrate) articulates with the stapes in the mammals, exactly as is the case in the urodeles. Nothing similar occurs in the Sauropsida. This is regarded as additional evidence that the mammals have had an amphibian ancestry. The quadrate cannot have disappeared in the glenoid fossa, as maintained by Albrecht and Cope, as this would involve a translation of parts impossible to explain. The mammalian lower jaw articulates by means of the dentary

rather than by means of the articular, *i. e.*, its articulation is not homologous with that in lower groups. A longer summary of the paper will appear in the *American Naturalist* for March.

*Notes on Mammalian Embryology.* C. S. MINOT. (Read by title.)

*Professor O. van der Stricht's Researches on the Human Ovum.* C. S. MINOT. (Read by title.)

*Notes on the Morphology of the Chick Brain.* S. P. GAGE.

*A Specific Case of the Elimination of the Unfit.* H. C. BUMPUS.

THE results of a comparative study of one hundred and thirty-six English sparrows, which were rendered helpless or actually perished during the severe storm of February last, was numerically expressed, and it was shown that there was not only a measurable but a striking physical difference between the birds which actually succumbed and those which survived the storm. The birds which perished were longer, heavier, possessed of shorter heads, shorter leg bones, of less breadth of skull and of reduced sternum, while those which survived tended toward the possession of characters opposite to these.

While these average differences between the two groups of birds were emphasized, attention was also called to the fact that the individuals of extreme variability occurred most frequently among the birds which perished. The longest bird and the shortest bird in the entire collection perished. The same is true of the one having the greatest and the one having the least alar extent. The heaviest bird died; the one with the longest and the one with the shortest head died, and the one with the shortest humerus, the one with the longest femur, the one with the longest and the one with the shortest skull, and the one with the shortest keel to

its sternum—all died. The average oscillation of variation around an ideal mean was also shown to be almost invariably in excess for the birds which perished, and the conclusions arrived at were as follows:

The birds which perished were not simply accidental sufferers from the severity of the storm, but were birds which were physically disqualified for enduring the intensity of the New England climate, as expressed by the storm of February 1st, and they were consequently eliminated by natural agents. The result of this elimination produced in this particular locality a colony of birds measurably different from those existing before the storm, that is, the action of natural selection resulted in the elimination of the unfit and the survival of the fit.

*On the Anatomy of the Spermatozoon of Invertebrates.* G. W. FIELD. (With demonstration of the apical body.)

THE widest diversity in the form of the spermatozoon is found among the different groups of the invertebrated animals. Closer examination shows that there is, however, one type of form which obtains in by far the greater majority of species, and that the aberrant forms are peculiar to those species which have either become parasitic, *e. g.*, certain worms and arthropods, or which have acquired specially modified secondary sexual organs, *e. g.*, lobster, crayfish, *Limulus*.

The common type is the familiar tailed form, prevalent one in the groups Cœlenterata, Vermes, Echinoderma, Mollusca, Arthropoda and Tunicata. The three general divisions are usually distinct and readily recognizable. Rarely the spermatozoa of all the species studied have a special structure or apical body at the anterior tip of the head. It has been variously described as (1) an adaptation for boring into the egg; (2) a remnant of the cytoplasm; (3) fluid expressed from the nucleus upon

shrivelling; (4) a micropore surrounded by 'Ringkörper'; (5) an apical button present in the unripe spermatozoon; (6) the sperm centrosome. The first five opinions seem to have little importance when considered in connection with the origin of this apical body. While the opinion of myself and others that it is the sperm centrosome is refuted by the weight of evidence that the sperm centrosome comes from the middle piece of the spermatozoon, yet, so far as I know, the function of this apical body has not been noted by any of those who have studied so successfully the fertilization process. Since it has the same microchemical reactions and the same origin as the middle piece, it would appear as if its fate must be of considerable consequence. I have found this apical body in more than forty species, representing all the groups from the Cœlenterates to Amphioxus (including *Toxopneustes*). By others it has been found in upwards of twenty additional species.

The fact that the apical body is present in the spermatozoon of well-nigh every species studied indicates that it has some very special significance which should not be overlooked by workers on the phenomena of fertilization.

*The Middle Piece of the Urodele Spermatozoon.* J. H. MCGREGOR. (Read by title.)

*The Origin of the Yolk in the Egg of Molgula.* HENRY E. CRAMPTON, JR.

THE author presented the principal results of an extended study upon the early history of the ascidian oöcyte, considered from a chemical as well as from a purely morphological aspect, made by means of carefully controlled aniline staining supported by artificial digestion and other tests. It was found that the cell-body at the beginning of enlargement of the primary oöcyte presents no albumen reaction. There is, however, a small albuminous gran-